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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/168,770	10/08/1998	RASHMI K. SHAH	TH-1042(US)	2851

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EXAMINER	
RIDLEY, BASIA ANNA	
ART UNIT	**PAPER NUMBER**
1764	

DATE MAILED: 11/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/168,770	Applicant(s) SHAH ET AL.
	Examiner Basia Ridley	Art Unit 1764

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 July 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12,14-18 and 20-24* is/are pending in the application.

4a) Of the above claim(s) *8-12* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,14-18 and 20-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *073004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The following document, EP 0,450,872 A1, cited in the information disclosure statement filed on 30 July 2004, has already been considered, as indicated by PTO-892, part of Paper No. 15, mailed on 1 May 2001.

Claim Rejections - 35 USC § 102

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1-7, 14-18 and 20-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Ruhl (EP 0 450 872).

Regarding claim(s) 1-6 and 14-17, Ruhl, in Fig. 4, disclose(s) a process heater comprising:

- an oxidation chamber (30, 68) having an inlet for an oxidant, an outlet for combustion products and a flow path between the inlet and the outlet (Fig. 4);
- a fuel conduit (60, 68) for transporting a fuel to the oxidation chamber, the fuel conduit (60, 68) containing a plurality of fuel nozzles (64) along substantially the entire length of the oxidation chamber (30, 68), each nozzle (64) providing fluid communication from within the fuel conduit (60, 68) to the oxidation chamber (30, 68), the fuel nozzles being spaced so that fuel is added to the oxidation chamber (30, 68) at a rate that no flame results when the fuel is mixed with the oxidant flowing through the flow path in the oxidation chamber (Fig. 4), thereby producing flameless distributed combustion throughout said oxidation chamber (Fig. 4);

- a preheater in fluid communication with the oxidation chamber inlet, the preheater capable of preheating said oxidant to a temperature at which when said oxidant and the fuel are mixed in said oxidation chamber, the temperature of said mixture of oxidant and fuel exceeds the autoignition temperature of said mixture (P5/L41-57, P7/L4-11, Fig. 4); and

- a process chamber (20) in a heat exchange relationship with the oxidation chamber (Fig. 4), whereby a controllable heat flux is provided to the process chamber at a sufficiently high rate to complete the endothermic chemical process being conducted therein, and the heat transferred from the oxidation chamber to the process chamber does not cause the temperature of the mixture of the oxidant and the fuel within the oxidation chamber to decrease below the autoignition temperature of said mixture of oxidant and fuel in the oxidation (abstract, P3/L3-21, P5/L36-57, P6/L7-25, P7/L4-11, P8/L29-33, Fig. 4);

- a coke inhibitor injection system in fluid communication with the fuel conduit wherein an amount of coke inhibitor is supplied effective to inhibit coke formation at fuel conduit operating temperatures (P3/L48-55, P5/L8-10); wherein

- the fuel conduit is a tubular conduit essentially centrally located within the oxidation reaction chamber (Fig. 4);

- the oxidation chamber is essentially centrally located within the process chamber (Fig. 4);

- the process chamber is a pyrolysis reaction chamber for thermal cracking of hydrocarbons in production of olefins (P3/L3-21);

- the process chamber contains a catalyst and is used for steam methane reforming

(P3/L3-21);

- wherein the endothermic chemical reaction is conducted in a single stage and heat is provided to the process chamber by the oxidation chamber at a controlled temperature profile (abstract, P3/L3-21, P5/L36-57, P6/L7-25, P7/L4-11, P8/L29-33, Fig. 4);
- the oxidant is preheated by heat exchange with effluent from the process chamber (Fig. 4).

Regarding claim(s) 7 and 14-15 it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (1987).

Regarding claims 1-7 and 14-17, statements in the preamble reciting the purpose or intended use of the claimed invention which do not result in a structural difference (or, in the case of process claims, manipulative difference) between the claimed invention and the prior art do not limit the claim and do not distinguish over the prior art apparatus (or process). See, e.g., *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963); *In re Sinex*, 309 F.2d 488, 492, 135 USPQ 302, 305 (CCPA 1962). If a prior art structure is capable of performing the intended use as recited in the preamble, then it meets the claim. See, e.g., *In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997) and cases cited therein, as it has been held that the recitation of a new intended use for an old product does not make a claim to that old product patentable. *In re Schreiber*, 44 USPQ2d 1429 (Fed. Cir. 1997). See also MPEP § 2111.02 and § 2112 - § 2112.02.

Regarding limitations recited in claims 1-7 and 14-17 which are directed to a manner of operating disclosed process heater, the examiner notes that neither the manner

of operating a disclosed device nor material or article worked upon further limit an apparatus claim. Said limitations do not differentiate apparatus claims from prior art. See MPEP § 2114 and 2115. Further, the examiner notes that process limitations do not have patentable weight in an apparatus claim. See *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969) that states "Expressions relating the apparatus to contents thereof and to an intended operation are of no significance in determining patentability of the apparatus claim."

Regarding claim(s) 18, 20-21 and 23-24, Ruhl, in Fig. 4, disclose(s) a process heater comprising:

- an oxidation chamber (30, 68) having an inlet for an oxidant, an outlet for combustion products and a flow path between the inlet and the outlet (Fig. 4);
- a fuel conduit (60, 68) for transporting fuel into said oxidation chamber, said fuel conduit (60, 68) containing a plurality of fuel nozzles (64) distributed along substantially the entire length of said oxidation chamber (30, 68), said fuel nozzles (64) being spaced so that the flow of said fuel through said fuel nozzles (64) results in no flame when the fuel passes through the nozzles and is mixed with said oxidant flowing through said flow path in said oxidation chamber (Fig. 4), thereby producing flameless distributed combustion throughout said oxidation chamber (Fig. 4);
- a preheater in fluid communication with said oxidation chamber, for preheating said oxidant to above a temperature at which when said oxidant and said fuel are mixed in said oxidation chamber, the temperature of said mixture of said oxidant and said fuel exceeds the autoignition temperature of said mixture (P5/L41-57, P7/L4-11, Fig. 4); and
- a process chamber (20) in a heat exchange relationship with said oxidation chamber

(Fig. 4), said plurality of nozzles distributed along substantially the entire length of said oxidation chamber being sized to provide the desired temperature distribution within said process chamber and the heat flux necessary to complete the endothermic chemical process being conducted therein (abstract, P3/L3-21, P5/L36-57, P6/L7-25, P7/L4-11, P8/L29-33, Fig. 4); wherein

- the process chamber is a pyrolysis reaction chamber for thermal cracking of hydrocarbons in production of olefins (P3/L3-21);
- the endothermic chemical reaction is conducted in a single reaction stage at a controlled temperature profile (abstract, P3/L3-21, P5/L36-57, P6/L7-25, P7/L4-11, P8/L29-33, Fig. 4);
- the process chamber contains a catalyst and the process conducted in said process chamber is steam hydrocarbon reforming (P3/L3-21); and
- said oxidant is preheated by heat exchange with effluent from the process chamber (Fig. 4).

Regarding claim(s) 22 it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (1987).

Regarding claims 18 and 20-24, statements in the preamble reciting the purpose or intended use of the claimed invention which do not result in a structural difference (or, in the case of process claims, manipulative difference) between the claimed invention and the prior art do not limit the claim and do not distinguish over the prior art apparatus (or process). See, e.g., *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963); *In*

re Sinex, 309 F.2d 488, 492, 135 USPQ 302, 305 (CCPA 1962). If a prior art structure is capable of performing the intended use as recited in the preamble, then it meets the claim. See, e.g., *In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997) and cases cited therein, as it has been held that the recitation of a new intended use for an old product does not make a claim to that old product patentable. *In re Schreiber*, 44 USPQ2d 1429 (Fed. Cir. 1997). See also MPEP § 2111.02 and § 2112 - § 2112.02.

Regarding limitations recited in claims 18 and 20-24 which are directed to a manner of operating disclosed process heater, the examiner notes that neither the manner of operating a disclosed device nor material or article worked upon further limit an apparatus claim. Said limitations do not differentiate apparatus claims from prior art. See MPEP § 2114 and 2115. Further, the examiner notes that process limitations do not have patentable weight in an apparatus claim. See *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969) that states "Expressions relating the apparatus to contents thereof and to an intended operation are of no significance in determining patentability of the apparatus claim."

3. Claims 1-5, 16-18, 20-21 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Mikus (USP 5,255,742).

Regarding claim(s) 1-4 and 16-17, Mikus, in Fig. 2-3 and 6, disclose(s) a process heater comprising:

- an oxidation chamber having an inlet for an oxidant, an outlet for combustion products and a flow path between the inlet and the outlet (Fig. 2-3);
- a fuel conduit for transporting a fuel to the oxidation chamber, the fuel conduit containing a plurality of fuel nozzles (13) along substantially the entire length of the

oxidation chamber, each nozzle (13) providing fluid communication from within the fuel conduit to the oxidation chamber, the fuel nozzles (13) being spaced so that fuel is added to the oxidation chamber at a rate that no flame results when the fuel is mixed with the oxidant flowing through the flow path in the oxidation chamber (Fig. 3), thereby producing flameless, distributed combustion throughout said oxidation chamber (Fig. 3);

- a preheater in fluid communication with the oxidation chamber inlet, the preheater capable of preheating said oxidant to a temperature at which when said oxidant and the fuel are mixed in said oxidation chamber, the temperature of said mixture of oxidant and fuel exceeds the autoignition temperature of said mixture (C3/L25-30, Fig. 2-3); and
- process chamber (1) in a heat exchange relationship with the oxidation chamber (Fig. 2-3), whereby a controllable heat flux is provided to the process chamber at a sufficiently high rate to complete the endothermic chemical process being conducted therein (C1/L13-44), and the heat transferred from the oxidation chamber to the process chamber does not cause the temperature of the mixture of the oxidant and the fuel within the oxidation chamber to decrease below the autoignition temperature of said mixture of oxidant and fuel in the oxidation (abstract, C9/L56-C10/L13, Fig. 2-3);
- a coke inhibitor injection system in fluid communication with the fuel conduit wherein an amount of coke inhibitor is supplied effective to inhibit coke formation at fuel conduit operating temperatures (C6/L25-C7/L8); wherein
- the fuel conduit is a tubular conduit essentially centrally located within the oxidation reaction chamber (Fig. 2-3);
- the oxidation chamber is essentially centrally located within the process chamber (Fig. 3);

- the endothermic chemical reaction is conducted in a single stage and heat is provided to the process chamber by the oxidation chamber at a controlled temperature profile (Fig. 6 and C9/L56-C10/L14);
- the oxidant is preheated by heat exchange with effluent from the process chamber (Fig. 2).

Regarding claim(s) 5 Mikus discloses all of the claim limitations as set forth above. Additionally the reference discloses that the endothermic chemical process includes thermal cracking of hydrocarbons to more valuable products (C1/L37-44). While the reference does not explicitly disclose said products comprising olefins, production of at least some olefins is inherent in the process chamber disclosed by Mikus. Further, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (1987).

Regarding claims 1-5 and 16-17, statements in the preamble reciting the purpose or intended use of the claimed invention which do not result in a structural difference (or, in the case of process claims, manipulative difference) between the claimed invention and the prior art do not limit the claim and do not distinguish over the prior art apparatus (or process). See, e.g., *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963); *In re Sinex*, 309 F.2d 488, 492, 135 USPQ 302, 305 (CCPA 1962). If a prior art structure is capable of performing the intended use as recited in the preamble, then it meets the claim. See, e.g., *In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997) and cases cited therein, as it has been held that the recitation of a new intended use for an

old product does not make a claim to that old product patentable. *In re Schreiber*, 44 USPQ2d 1429 (Fed. Cir. 1997). See also MPEP § 2111.02 and § 2112 - § 2112.02.

Regarding limitations recited in claims 1-5 and 16-17 which are directed to a manner of operating disclosed process heater, the examiner notes that neither the manner of operating a disclosed device nor material or article worked upon further limit an apparatus claim. Said limitations do not differentiate apparatus claims from prior art. See MPEP § 2114 and 2115. Further, the examiner notes that process limitations do not have patentable weight in an apparatus claim. See *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969) that states "Expressions relating the apparatus to contents thereof and to an intended operation are of no significance in determining patentability of the apparatus claim."

Regarding claim(s) 18, 21 and 24, Mikus, in Fig. 2-3 and 6, disclose(s) a process heater comprising:

- an oxidation chamber having an inlet for an oxidant, an outlet for combustion products and a flow path between the inlet and the outlet (Fig. 2-3);
- a fuel conduit for transporting fuel into said oxidation chamber, said fuel conduit containing a plurality of fuel nozzles (13) distributed along substantially the entire length of said oxidation chamber, said fuel nozzles (13) being spaced so that the flow of said fuel through said fuel nozzles (13) results in no flame when the fuel passes through the nozzles and is mixed with said oxidant flowing through said flow path in said oxidation chamber (Fig. 2-3), thereby producing flameless, distributed combustion throughout said oxidation chamber (abstract);
- a preheater in fluid communication with said oxidation chamber inlet, for preheating

said oxidant to above a temperature at which when said oxidant and said fuel are mixed in said oxidation chamber, the temperature of said mixture of said oxidant and said fuel exceeds the autoignition temperature of said mixture (C3/L25-30, Fig. 2-3); and

- a process chamber (1) in a heat exchange relationship with said oxidation chamber (Fig. 2-3), said plurality of nozzles distributed along substantially the entire length of said oxidation chamber being sized to provide the desired temperature distribution within said process chamber and the heat flux necessary to complete the endothermic chemical process being conducted therein (abstract, C1/L13-44, C5/L41-65, C9/L56-C10/L14, Fig. 2-3); wherein

- the endothermic chemical reaction is conducted in a single reaction stage at a controlled temperature profile (Fig. 6 and C9/L56-C10/L14);

- said oxidant is preheated by heat exchange with effluent from the process chamber (Fig. 2).

Regarding claim(s) 20 Mikus discloses all of the claim limitations as set forth above. Additionally the reference discloses that the endothermic chemical process includes thermal cracking of hydrocarbons to more valuable products (C1/L37-44). While the reference does not explicitly disclose said products comprising olefins, production of at least some olefins is inherent in the process chamber disclosed by Mikus. Further, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (1987).

Regarding claims 18, 20-21 and 24, statements in the preamble reciting the

purpose or intended use of the claimed invention which do not result in a structural difference (or, in the case of process claims, manipulative difference) between the claimed invention and the prior art do not limit the claim and do not distinguish over the prior art apparatus (or process). See, e.g., *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963); *In re Sinex*, 309 F.2d 488, 492, 135 USPQ 302, 305 (CCPA 1962). If a prior art structure is capable of performing the intended use as recited in the preamble, then it meets the claim. See, e.g., *In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997) and cases cited therein, as it has been held that the recitation of a new intended use for an old product does not make a claim to that old product patentable. *In re Schreiber*, 44 USPQ2d 1429 (Fed. Cir. 1997). See also MPEP § 2111.02 and § 2112 - § 2112.02.

Regarding limitations recited in claims 18, 20-21 and 24 which are directed to a manner of operating disclosed process heater, the examiner notes that neither the manner of operating a disclosed device nor material or article worked upon further limit an apparatus claim. Said limitations do not differentiate apparatus claims from prior art. See MPEP § 2114 and 2115. Further, the examiner notes that process limitations do not have patentable weight in an apparatus claim. See *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969) that states "Expressions relating the apparatus to contents thereof and to an intended operation are of no significance in determining patentability of the apparatus claim."

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claim(s) 1-7, 14-18 and 20-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ruhl (EP 0 450 872).

Regarding claim(s) 1-7, 14-18 and 20-24, Ruhl discloses all of the claim limitations as set forth above. To the extent that the applicant argues that Ruhl, in Fig. 4, does not show the plurality of nozzles distributed along substantially the entire length of the oxidation chamber, it would be obvious to an ordinary artisan at the time of the invention to extend said plurality of nozzles, as Ruhl teaches that said nozzles are "at spaced intervals along its length" (P5/L51-52). While one embodiment of spaced nozzles arrangement is presented in Fig. 4, the reference does not exclude other embodiments, including ones where the area having the nozzles is extended to cover substantially the entire length of the oxidation chamber. In view of this disclosure, it would be obvious to an ordinary artisan at the time of the to extend said oxidation chamber to cover substantially the entire length of the apparatus maintaining said plurality of nozzles throughout substantially the entire length of the oxidation chamber.

5. Claim(s) 6-7, 14-15 and 22-23 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Mikus (USP 5,255,742), as applied to claims 1 and 18 above.

Regarding claim 6-7, 14-15 and 22-23, Mikus discloses all of the claim limitations as set forth above. Additionally Mikus discloses that the heater is used for an endothermic process (abstract, C1/L13-44) and that the absence of flame eliminates the flame as a radiant heat source and results in more even temperature distribution throughout the length of the heater (abstract). Further said heater eliminates the hot spots within the heater and structures surrounding the heater, which originate from the radiant heat transfer from the luminous portion of the flame. Said process heater not only

optimizes the process operation but it is also less expensive than a process heater operating with flames because of less expensive materials of construction (C2/L4-12). While the reference discloses said heater being used to provide heat to an endothermic chemical reaction, such as thermal cracking of hydrocarbons, as set forth above, the reference does not explicitly disclose said heater being used in other chemical processes, such as catalytic steam methane reforming, catalytic production styrene by dehydrogenation of ethyl benzene, vacuum distillation of feed or hydrocarbon distillation in a column reboiler. Since all of claimed specific chemical reactions are endothermic processes, which routinely are heated by process heaters comprising burners operating with flames they will benefit from the benefits associated with process heater of Mikus as set forth above. An ordinary artisan at the time of the invention would have replaced the heaters in various endothermal process chambers with the process heater of Mikus for the purpose of providing more even temperature distribution throughout the length of the burner and lowering the costs of said process chambers. Further, use of the process heater of Mikus for said process heaters in various endothermic reaction chambers would amount to nothing more than to use of a known process heater for its intended use in a known environment to accomplish entirely expected result.

Regarding claims 6-7, 14-15 and 22-23, statements in the preamble reciting the purpose or intended use of the claimed invention which do not result in a structural difference (or, in the case of process claims, manipulative difference) between the claimed invention and the prior art do not limit the claim and do not distinguish over the prior art apparatus (or process). See, e.g., *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963); *In re Sinex*, 309 F.2d 488, 492, 135 USPQ 302, 305 (CCPA 1962). If

a prior art structure is capable of performing the intended use as recited in the preamble, then it meets the claim. See, e.g., *In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997) and cases cited therein, as it has been held that the recitation of a new intended use for an old product does not make a claim to that old product patentable. *In re Schreiber*, 44 USPQ2d 1429 (Fed. Cir. 1997). See also MPEP § 2111.02 and § 2112 - § 2112.02.

Regarding limitations recited in claims 6-7, 14-15 and 22-23 which are directed to a manner of operating disclosed process heater, the examiner notes that neither the manner of operating a disclosed device nor material or article worked upon further limit an apparatus claim. Said limitations do not differentiate apparatus claims from prior art. See MPEP § 2114 and 2115. Further, the examiner notes that process limitations do not have patentable weight in an apparatus claim. See *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969) that states "Expressions relating the apparatus to contents thereof and to an intended operation are of no significance in determining patentability of the apparatus claim."

6. Claim(s) 1-7, 14-18 and 20-24 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Ruhl (EP 0 450 872) in view of Mikus (USP 5,255,742).

Regarding claim(s) 1, Ruhl, in Fig.1, disclose(s) a process heater comprising:

- an oxidation chamber (30) having an inlet (40) for an oxidant, an outlet (54) for combustion products and a flow path between the inlet and the outlet (Fig. 1);
- a fuel conduit (34) for transporting a fuel to the oxidation chamber, the fuel conduit (34) containing a fuel nozzle (Fig. 1), said nozzle providing fluid communication from within the fuel conduit (34) to the oxidation chamber (30);

- a preheater in fluid communication with the oxidation chamber inlet (40), the preheater capable of preheating said oxidant to a temperature at which when said oxidant and the fuel are mixed in said oxidation chamber, the temperature of said mixture of oxidant and fuel exceeds the autoignition temperature of said mixture (P5/L51-57, P7/L4-11, Fig. 1); and

- a process chamber (20) in a heat exchange relationship with the oxidation chamber (Fig. 1), whereby a controllable heat flux is provided to the process chamber at a sufficiently high rate to complete the endothermic chemical process being conducted therein, and the heat transferred from the oxidation chamber to the process chamber does not cause the temperature of the mixture of the oxidant and the fuel within the oxidation chamber to decrease below the autoignition temperature of said mixture of oxidant and fuel in the oxidation (P5/L36-57, P6/L7-25, P7/L4-11, P8/L29-33, Fig. 1).

Further Ruhl discloses an embodiment wherein the process heater is designed to operate with low temperature differentials (P6/L7-10). To enable operation with low temperature differentials the reference discloses embodiments where the so called "low temperature seals" are replaced by "high temperature seals" (P6/L29-31) or where an alternative mode of operation is provided which allows said "low temperature seals" to effectively operate at high temperatures (P6/L57-P7/L2). While Ruhl shows embodiments of the process heater operating without a flame (see Fig. 4), such operation is not disclosed with respect to Fig. 1.

Mikus, in Fig. 2-3 and 6, teaches a process heater comprising:

- an oxidation chamber having an inlet for an oxidant, an outlet for combustion products and a flow path between the inlet and the outlet (Fig. 2-3);

- a fuel conduit for transporting a fuel to the oxidation chamber, the fuel conduit containing a plurality of fuel nozzles (13) along substantially the entire length of the oxidation chamber, each nozzle (13) providing fluid communication from within the fuel conduit to the oxidation chamber, the fuel nozzles (13) being spaced so that fuel is added to the oxidation chamber at a rate that no flame results when the fuel is mixed with the oxidant flowing through the flow path in the oxidation chamber (Fig. 2-3), thereby producing flameless, distributed combustion throughout said oxidation chamber (Fig. 2-3);
- a preheater in fluid communication with the oxidation chamber inlet, the preheater capable of preheating said oxidant to a temperature at which when said oxidant and the fuel are mixed in said oxidation chamber, the temperature of said mixture of oxidant and fuel exceeds the autoignition temperature of said mixture (C3/L25-30, Fig. 2-3); and
- a process chamber (1) in a heat exchange relationship with the oxidation chamber (Fig. 2-3), whereby a controllable heat flux is provided to the process chamber at a sufficiently high rate to complete the endothermic chemical process being conducted therein (C1/L13-44), and the heat transferred from the oxidation chamber to the process chamber does not cause the temperature of the mixture of the oxidant and the fuel within the oxidation chamber to decrease below the autoignition temperature of said mixture of oxidant and fuel in the oxidation (abstract, C9/L56-C10/L13, Fig. 2-3);

In said process heater preheating at least the air stream and then mixing the fuel gas into the combustion air in relatively small increments will result in the flameless combustion (C4/27-40). The absence of flame eliminates the flame as a radiant heat source and results in more even temperature distribution throughout the length of the

burner (abstract). Further it eliminates the hot spots within the burner and structures surrounding the burner, which originate from the radiant heat transfer from the luminous portion of the flame. Said process heater not only optimizes the process operation but it is also less expensive than a process heater operating with flames because of less expensive materials of construction (C2/L4-12).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace the heater in the apparatus of Ruhl with the heater of Mikus for the purpose of providing more even temperature distribution throughout the length of the burner and lowering the costs of said apparatus.

Regarding claims 2-6 and 16-17 Ruhl in view of Mikus disclose all of the claim limitations as set forth above. Additionally Ruhl discloses the process heater further comprising:

- a coke inhibitor injection system in fluid communication with the fuel conduit wherein an amount of coke inhibitor is supplied effective to inhibit coke formation at fuel conduit operating temperatures (P3/L48-55, P5/L8-10); wherein
- the fuel conduit is a tubular conduit essentially centrally located within the oxidation reaction chamber (Fig. 1);
- the oxidation chamber is essentially centrally located within the process chamber (Fig. 1);
- the process chamber is a pyrolysis reaction chamber for thermal cracking of hydrocarbons in production of olefins (P3/L3-21);
- the process chamber contains a catalyst and is used for steam methane reforming (P3/L3-21); and

- wherein the endothermic chemical reaction is conducted in a single stage and heat is provided to the process chamber by the oxidation chamber at a controlled temperature profile (abstract, Fig. 1, P3/L3-21, P5/L36-57, P6/L7-25, P7/L4-11, P8/L29-33);
- the oxidant is preheated by heat exchange with effluent from the process chamber (Fig. 1).

Regarding claim(s) 7 and 14-15 it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (1987).

Regarding claims 1-7 and 14-17, statements in the preamble reciting the purpose or intended use of the claimed invention which do not result in a structural difference (or, in the case of process claims, manipulative difference) between the claimed invention and the prior art do not limit the claim and do not distinguish over the prior art apparatus (or process). See, e.g., *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963); *In re Sinex*, 309 F.2d 488, 492, 135 USPQ 302, 305 (CCPA 1962). If a prior art structure is capable of performing the intended use as recited in the preamble, then it meets the claim. See, e.g., *In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997) and cases cited therein, as it has been held that the recitation of a new intended use for an old product does not make a claim to that old product patentable. *In re Schreiber*, 44 USPQ2d 1429 (Fed. Cir. 1997). See also MPEP § 2111.02 and § 2112 - § 2112.02.

Regarding limitations recited in claims 1-7 and 14-17 which are directed to a manner of operating disclosed process heater, the examiner notes that neither the manner of operating a disclosed device nor material or article worked upon further limit an

apparatus claim. Said limitations do not differentiate apparatus claims from prior art. See MPEP § 2114 and 2115. Further, the examiner notes that process limitations do not have patentable weight in an apparatus claim. See *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969) that states "Expressions relating the apparatus to contents thereof and to an intended operation are of no significance in determining patentability of the apparatus claim."

Regarding claim(s) 18, Ruhl, in Fig.1, disclose(s) a process heater comprising:

- an oxidation chamber (30) having an inlet (40) for an oxidant, an outlet (54) for combustion products and a flow path between the inlet and the outlet (Fig.1);
- a fuel conduit (34) for transporting a fuel to the oxidation chamber, the fuel conduit (34) containing a fuel nozzle (Fig. 1), said nozzle providing fluid communication from within the fuel conduit (34) to the oxidation chamber (30);
- a preheater in fluid communication with said oxidation chamber inlet, for preheating said oxidant to above a temperature at which when said oxidant and said fuel are mixed in said oxidation chamber, the temperature of said mixture of said oxidant and said fuel exceeds the autoignition temperature of said mixture (P5/L51-57, P7/L4-11, Fig. 1); and
- a process chamber (20) in a heat exchange relationship with said oxidation chamber (Fig. 1), said nozzle being sized to provide the desired temperature distribution within said process chamber and the heat flux necessary to complete the endothermic chemical process being conducted therein (P5/L36-57, P6/L7-25, P7/L4-11, P8/L29-33, Fig. 4).

Further Ruhl discloses an embodiment wherein the process heater is designed to operate with low temperature differentials (P6/L7-10). To enable operation with low temperature differentials the reference discloses embodiments where the so called "low

temperature seals" are replaced by "high temperature seals" (P6/L29-31) or where an alternative mode of operation is provided which allows said "low temperature seals" to effectively operate at high temperatures (P6/L57-P7/L2). While Ruhl shows embodiments of the process heater operating without a flame (see Fig. 4), such operation is not disclosed with respect to Fig. 1.

Regarding Mikus the same comments apply as set forth above.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace the heater in the apparatus of Ruhl with the heater of Mikus for the purpose of providing more even temperature distribution throughout the length of the burner and lowering the costs of said apparatus.

Regarding claims 20-21 and 23-24 Ruhl in view of Mikus disclose all of the claim limitations as set forth above. Additionally Ruhl discloses the process heater wherein:

- the process chamber is a pyrolysis reaction chamber for thermal cracking of hydrocarbons in production of olefins (P3/L3-21);
- the endothermic chemical reaction is conducted in a single reaction stage at a controlled temperature profile (Fig. 1, P3/L3-21, P5/L36-57, P6/L7-25, P7/L4-11, P8/L29-33);
- the process chamber contains a catalyst and the process conducted in said process chamber is steam hydrocarbon reforming (P3/L3-21); and
- said oxidant is preheated by heat exchange with effluent from the process chamber (Fig. 1).

Regarding claim(s) 22 it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the

claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (1987).

Regarding claims 18 and 20-24, statements in the preamble reciting the purpose or intended use of the claimed invention which do not result in a structural difference (or, in the case of process claims, manipulative difference) between the claimed invention and the prior art do not limit the claim and do not distinguish over the prior art apparatus (or process). See, e.g., *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963); *In re Sinex*, 309 F.2d 488, 492, 135 USPQ 302, 305 (CCPA 1962). If a prior art structure is capable of performing the intended use as recited in the preamble, then it meets the claim. See, e.g., *In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997) and cases cited therein, as it has been held that the recitation of a new intended use for an old product does not make a claim to that old product patentable. *In re Schreiber*, 44 USPQ2d 1429 (Fed. Cir. 1997). See also MPEP § 2111.02 and § 2112 - § 2112.02.

Regarding limitations recited in claims 18 and 20-24 which are directed to a manner of operating disclosed process heater, the examiner notes that neither the manner of operating a disclosed device nor material or article worked upon further limit an apparatus claim. Said limitations do not differentiate apparatus claims from prior art. See MPEP § 2114 and 2115. Further, the examiner notes that process limitations do not have patentable weight in an apparatus claim. See *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969) that states "Expressions relating the apparatus to contents thereof and to an intended operation are of no significance in determining patentability of the apparatus claim."

7. This application currently names joint inventors. In considering patentability of

the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

Response to Arguments

8. Applicant's arguments filed on 30 July 2004 have been fully considered but they are not persuasive.

9. The applicant argues that the apparatus in Fig. 4 of Ruhl does not disclose the plurality of nozzles along substantially the entire length of the oxidation chamber and that the reference does not disclose "flameless, distributed combustion throughout the oxidation chamber", as recited in amended claims 1 and 18. Said arguments are not persuasive. Ruhl in Fig. 4 clearly shows flameless, distributed combustion throughout the oxidation chamber (part of tube 30 surrounding the burner zone 68), as set forth above. The examiner notes that the recitation "oxidation chamber" has been given its broadest reasonable interpretation in view of the specification, and as such, the apparatus of Ruhl comprising an oxidation chamber (a part of tube 30 surrounding the burner zone 68) and heat exchange conduits (parts of tube 30 surrounding the conduit 60 above and below the burner zone 68) reads on the instantly claimed invention, since the plurality of nozzles is, in fact, distributed over the substantially entire length of the oxidation chamber, as set forth above. To the extent that the applicant argues that Fig. 4 does not

explicitly show the nozzles along the entire length of feed tube 60, the examiner notes that the disclosure of Ruhl is not limited to the embodiment shown in Fig. 4. On page 5, line 51-53 Ruhl teaches that the nozzles are at spaced intervals along the length of the feed tube 60. Further, the reference is silent as to any requirements of a "non-burner zone" - area of the feed tube 60 which is free of the nozzles. In view of this disclosure, it would be obvious to an ordinary artisan at the time of the to extend said oxidation chamber to cover substantially the entire length of the apparatus maintaining said plurality of nozzles throughout substantially the entire length of the oxidation chamber. Applicant's arguments with respect to the low temperature seals limiting the area of the oxidation chamber in which flameless combustion may occur in the apparatus of Ruhl are not persuasive, because Ruhl teaches an alternative to said low temperature seals. On page 6, lines 29-32 Ruhl teaches "hot seals" which can comprise, for example, fused glass or ceramic cement. Further the reference teaches that while the upper operating temperature of the graphite foil seals is limited by oxidation, the apparatus can be operated with a controlled very slow leakage of process gas through the seal to sweep the air away from the seal material and permit the seals to exhibit long life at higher temperatures (see Ruhl, P6/L57-P7/L2).

10. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., apparatus being able to achieve the same desired temperature profiles that are achievable by applicant's apparatus) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed.

Cir. 1993). Further the examiner notes that limitations directed to a manner of operating disclosed process heater nor material or article worked upon further limit an apparatus claim. Said limitations do not differentiate apparatus claims from prior art. See MPEP § 2114 and 2115. Process limitations do not have patentable weight in an apparatus claim. See *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969) that states "Expressions relating the apparatus to contents thereof and to an intended operation are of no significance in determining patentability of the apparatus claim."

11. The applicant argues that Ruhl does not disclose preheating the oxidant by heat exchange with effluent from the process chamber. This is not found persuasive. Below is reproduced part of Fig. 4 of Ruhl with added annotations, which clearly shows that the oxidant in Oxidant Inlet Manifold 42 is preheated by heat exchange (heat is being inherently transferred by the Steel Plate 16) with reaction products produced in the process chamber and traveling towards the Outlet 24.

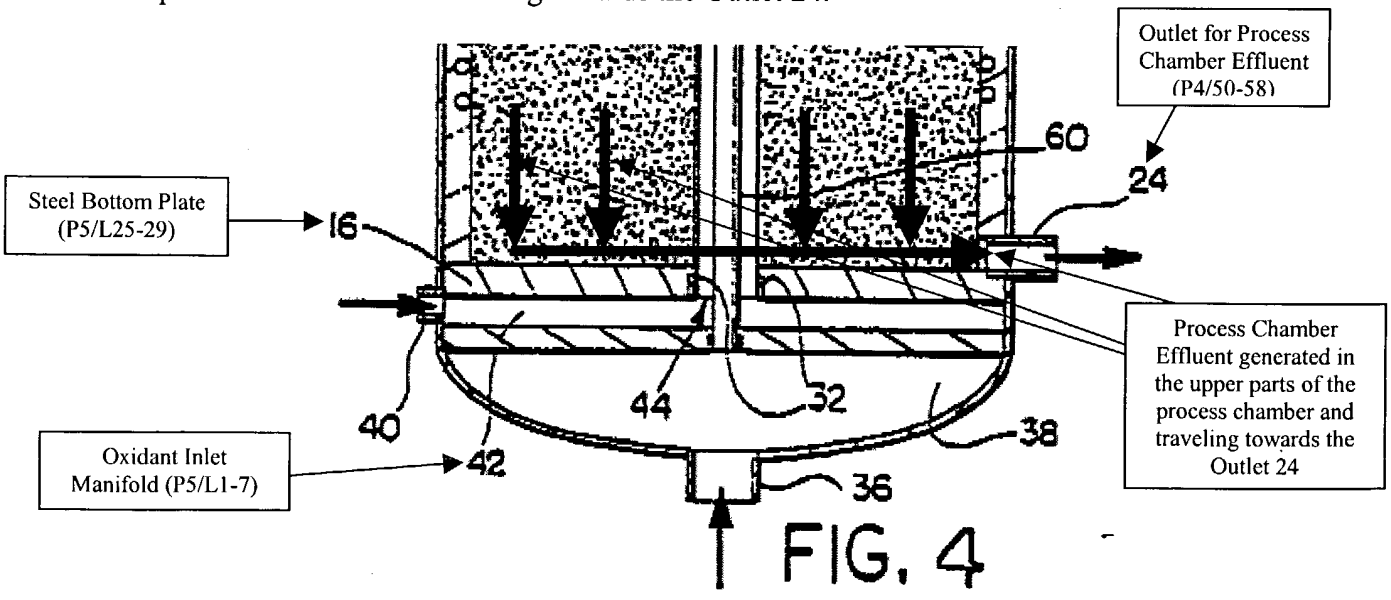


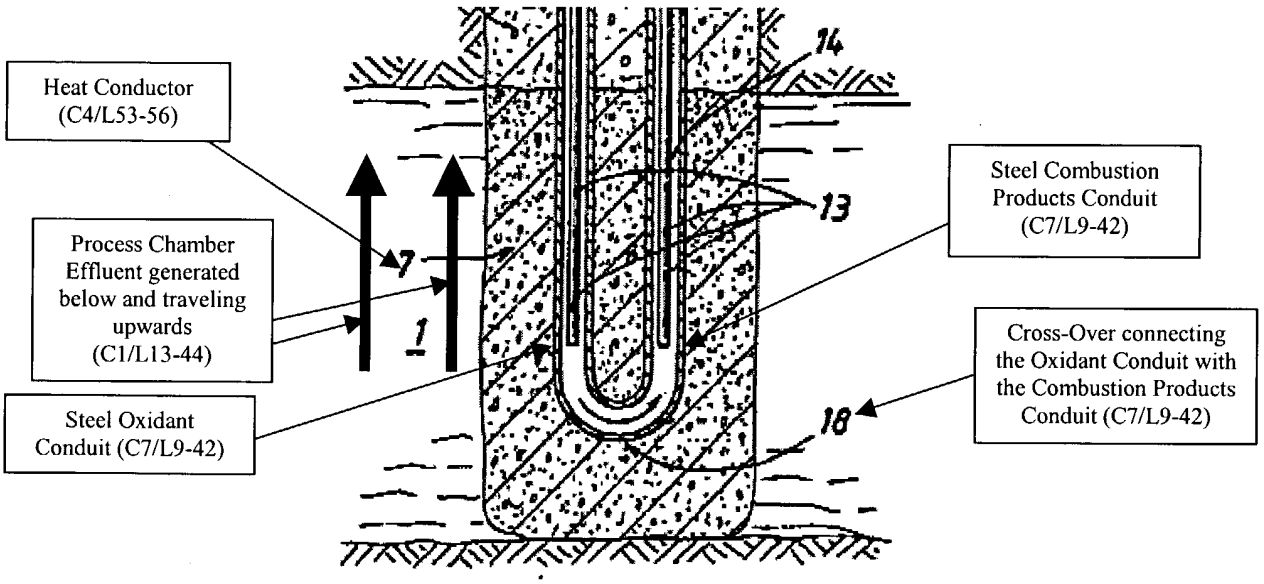
FIG. 4

12. The applicant argues that Mikus does not disclose an endothermic chemical process or process chamber. This is not found persuasive. Mikus does, in fact, disclose that heating of oil shale containing high molecular weight hydrocarbons or hydrocarbon solids promotes a chemical reaction, such as pyrolysis of the hydrocarbons in situ, wherein the products of said pyrolysis are hydrocarbons having lower molecular weight than the hydrocarbons contained in the oil shale (C1/L36-44). Further, Mikus does, in fact, disclose that said reaction occurs in at least one process chamber, since said high molecular weight hydrocarbons or hydrocarbon solids are contained in pores of the formation rock (C1/L30-36). In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., process chamber being created by Mikus or being an integral part of the process heater) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

13. Applicant argues that Mikus does not disclose process heater providing controllable heat flux to the process chamber at a sufficiently high rate to complete the endothermic process being conducted therein. This is not found persuasive. Mikus discloses process heater providing controllable heat flux (C5/L40-68) to the process chamber and promoting a chemical reaction, such as pyrolysis of the hydrocarbons in situ, as set forth above. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., heat flux being an order of magnitude greater than 375 watts per foot of length) are not recited in the rejected claim(s). Although the claims are interpreted in

light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

14. The applicant argues that Mikus does not disclose preheating the oxidant by heat exchange with effluent from the process chamber. This is not found persuasive. Below is reproduced part of Fig. 2 of Mikus with added annotations, which clearly shows that the oxidant in Oxidant Conduit is preheated by heat exchange (heat is being inherently transferred by the Heat Conductor 7 and Steel Oxidant Conduit) with reaction products, produced in the at least one process chamber, traveling upwards.



15. The applicant argues that it would not be obvious to substitute the heater of Mikus for the heater as shown in Fig. 1 of Ruhl or any other heater used in other endothermic processes because endothermic chemical reactors require higher heat flux, to support endothermic reactions occurring within said reactors, than a heat flux that could be produced by the flameless burner of Mikus. Additionally, the applicant states that said arguments are supported by an affidavit of Dr. Mikus filed on 8 December 2003. This is

not found persuasive. The statements in the affidavit that the flameless burner of the Mikus' reference provided only about 375 Watts per foot of length, while endothermic chemical processes could require a profile of heat flux varying with distance from 3,500 to 7,00 Watts per foot are not sufficient to overcame prima facie case, as set forth above.

It was known to one of ordinary skill in the art at the time of the invention, as shown by the cited references, that combustion temperature and a heat flux of a burner can be affected by a multitude of variables, for example flow rates of gases being burned, composition of fuel being burned and/or oxidant used in the burner, the tube design (materials of construction, length and diameter), heat transfer properties of material being heated, number of heaters, etc. In fact, the reference of Ruhl teaches that the apparatus can incorporate as many heater tubes as necessary to provide heat required by the process (see Ruhl, P5/L36-40) and that temperature of combustion gases, and inherently heat flux of the heater, can be varied by adjusting the fuel composition and flow rates of fuel and air (see Ruhl, P7/L4-7). The reference also teaches some exemplary length to inside diameter ratios which will achieve the required heat transfer for an exemplary process being conducted in the process chamber (P6/L7-10). Additionally, Mikus teaches that the heat transferred from disclosed process heater can be increased significantly by increasing the diameter of the heater (Mikus, C5/L15-25). The examiner notes that contrary to applicant's arguments an ordinary artisan would expect that variables taught by the references would affect heat transfer of any process heater, and not just the specific heaters of the references. The applicant has not presented any compelling argument or evidence to suggest that variables affecting heat transfer of heater disclosed in Ruhl would not have similar effect on heat transfer of the heater disclosed in Mikus.

In this regard, mere lawyer's arguments and conclusory statements, which are unsupported by factual evidence, are entitled to little probative value. *In re Linder*, 457 F.2d 506, 508-09, 173 USPQ 356, 358 (CCPA 1972); *In re De Blauwe*, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984); *In re Wood*, 582 F.2d 638, 642, 199 USPQ 137, 140 (CCPA 1978).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to replace the heater in the apparatus of Ruhl or any other endothermic process apparatus with the heater of Mikus for the purpose of providing more even temperature distribution throughout the length of the burner and lowering the costs of said apparatus, as set forth above. Additionally said skilled artisan would modify, among others, fuel composition and flow rates of fuel and air and/or the number of heaters in the apparatus of Ruhl (as taught by Ruhl), or the burner diameter (as taught by Mikus), in order to obtain temperatures and heat fluxes necessary to complete endothermic reactions run in said apparatus.

Further, the examiner notes that a reasonable expectation of success for this proposed use of flameless heater of Mikus in the apparatus of Ruhl is supported by the fact that Ruhl, in Fig. 4, discloses an embodiment wherein burner located in an oxidation zone comprises at least one fuel conduit comprising a plurality of fuel nozzles and does not have a flame.

16. The applicant argues that it would not be obvious to substitute the heater of Mikus for the heater as shown in Fig. 1 of Ruhl, because Ruhl uses relatively low temperature seals to seal the combustion tubes to the tube sheets and because the apparatus of Ruhl produces an uneven temperature distribution. This is not found persuasive. The

applicant's arguments with respect to the low temperature seals have already been answered above. The applicant argues that Ruhl only teaches replacing low temperature seals at the exhaust end of the combustion tube and not at the inlet end of the combustion tube. This is found not persuasive, as said teaching of Ruhl should not be taken so narrowly. On page 6, lines 29-32 Ruhl teaches that two types of seals can be used successfully in disclosed reactor, either hot temperature seals or low temperature seals. Said passage further teaches that the type of seal should be selected based on application and reactor operation and design. For example, when high temperature demands it a hot seal can be used and when hot seal is not necessary a low temperature seal can be used which offers other benefits, such as allowing for tube expansion. The more appropriate interpretation of this passage would be that the type of seal in the reactor of Ruhl is not critical and that various known seals can be used successfully in said reactor.

Regarding purged seal condition disclosed by Ruhl (P6/L57-P7/L2), while the applicant argues that said arrangement "certainly would not allow low temperature graphite foil seals to be used in place of high temperature seals", the applicant has not presented any compelling argument or evidence to support said statements. In this regard, mere lawyer's arguments and conclusory statements, which are unsupported by factual evidence, are entitled to little probative value. *In re Linder*, 457 F.2d 506, 508-09, 173 USPQ 356, 358 (CCPA 1972); *In re De Blauwe*, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984); *In re Wood*, 582 F.2d 638, 642, 199 USPQ 137, 140 (CCPA 1978).

17. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by

combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the motivation to do so is found in the references themselves. Regarding applicant's arguments with respect to an uneven temperature distribution being desired in the apparatus of Ruhl, the examiner would like to point the applicant to the disclosure of Ruhl, P6/L7-10, where the reference teaches the method of operating the reactor with low temperature differentials. In view of this disclosure it appears that the reference teaches at least one way of redesigning the apparatus to accomplish low temperature differentials. In view of this teaching and in view of teaching of Mikus, which discloses a flameless burner having low temperature differentials, it would have been obvious to one having ordinary skill in the art at the time of the invention to replace the burner of Ruhl with the burner of Mikus to allow the reactor of Ruhl to operate with low temperature differentials.

Since Mikus discloses that said process heater provides heat required for endothermic chemical reactions, such as pyrolysis of hydrocarbons. It is the examiner's position that once a heater has been used for an endothermic process and proven to be an improvement over heaters using flames, it would have been obvious to one having ordinary skill in the art at the time of the invention to use said heater in place of heaters using flames in any other endothermic process, as set forth above.

The motivation to do so is found in the references themselves, which state that it is desired to replace burners using flame with a flameless burners because the absence of

flame eliminates the flame as a radiant heat source and results in more even temperature distribution throughout the length of the burner and further it eliminates hot spots within the burner and structures surrounding the burner originating from the radiant heat transfer from the luminous portion of the flame (see Mikus, abstract and C2/L4-12). Additional motivation can be found in the knowledge generally available to one of ordinary skill in the art. Said artisan knows that, in any processes using a catalyst bed, a uniform temperatures through out said catalyst bed are optimal for the process operation. Elimination of hot and cooler spots throughout the catalyst bed will, for example, prolong catalyst life and optimize reaction rates throughout the entire catalyst bed.

Additionally, even if Ruhl did, arguendo, desire non-uniform temperature throughout the length of the oxidation chamber, the apparatus of Ruhl still would benefit from use of a flameless burner in a oxidation zone, since it would eliminate the hot spots within the burner and structures surrounding the burner, said hot spots originating from the radiant heat transfer from the luminous portion of the flame, since elimination of said hot spots would allow for construction of said burner from less expensive materials, as taught by Mikus, C2/L4-12. In fact, Ruhl, in Fig. 4, discloses an embodiment wherein burner located in an oxidation zone comprises a fuel conduit comprising a plurality of fuel nozzles and does not have a flame.

Conclusion

18. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Basia Ridley, whose telephone number is (571) 272-1453.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola, can be reached on (571) 272-1444.

The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Technical Center 1700 General Information Telephone No. is (571) 272-1700. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Questions on access to the Private PAIR system should be directed to the Electronic Business Center (EBC) at (866) 217-9197 (toll-free).

Basia Ridley
Examiner
Art Unit 1764

BR
October 28, 2004